

**A new species of rainfrog, *Eleutherodactylus phasma*
(Anura: Leptodactylidae), from Montane Costa Rica**

Karen R. Lips and Jay M. Savage

(KRL & JMS) Department of Biology, University of Miami, P.O. Box 249118,
Coral Gables, Florida 33124, U.S.A. (current address of KRL Department of Biology,
St. Lawrence University, Canton, New York 13617, U.S.A.)

Abstract.—*Eleutherodactylus phasma* (Leptodactylidae), a new rainfrog from the Cordillera de Talamanca, Costa Rica is described. The new form belongs to the *Eleutherodactylus fitzingeri* group, and can be distinguished from the other members of this group from Lower Central America by the combination of basal toe webbing, no heel tubercle, and its distinctive gray-white ghost-like coloration.

Resumen.—Se describe una nueva especie, *Eleutherodactylus phasma*, de la Cordillera de Talamanca al sureste de Costa Rica. Esta nueva forma puede ser distinguida de las otras por las membranas interdigitales en la base de los dedos, la ausencia de un tubérculo del talón, y la coloración inusual de blanco y gris.

In March 1992 the first author collected an unusually colored frog of the genus *Eleutherodactylus* in the southern Cordillera de Talamanca of Costa Rica. Aside from the black eyes and a scattering of black markings on the head and hindlimbs, the dorsal and ventral surfaces were a uniform ghost-like gray-white.

Initially we thought this specimen might be a partial albino of one of the several species of the genus from the same region. However, further study indicated that this frog differed from all congeners in significant morphological features.

Subsequent fieldwork in the same area in 1993 and 1994 failed to uncover additional examples of this form which we now believe represents a distinctive taxon. Consequently, we describe this specimen below in order that it may be included in the second author's handbook on the herpetofauna of Costa Rica. Because of its ghost-like appearance, this specimen is to be called:

Eleutherodactylus phasma, new species

Fig. 1

Holotype.—CRE 5331 (Costa Rican Expeditions, the private collection of JMS

housed at the University of Miami, to be deposited in the LACM) an adult female from Costa Rica: Puntarenas Province, Canton Coto Brus, Zona Protectora Las Tablas, Finca Jaguar, 8°55'N, 82°44'W on the Río Coton; ca. 20 km NNE of La Lucha, 1850 m elevation; taken 1 March 1992 by Karen R. Lips.

Etymology.—The species name is derived from the Greek *phasma* meaning an apparition or spirit, in reference to the ghost-like appearance of this white frog.

Diagnosis.—The new species is a member of the *Eleutherodactylus fitzingeri* series and *fitzingeri* species group as defined by Savage (1987). Within the *fitzingeri* group it shares with a number of taxa (*Eleutherodactylus cuaquero*, *E. emcelae*, *E. monnichorum*, and *E. rayo*) the features of basal toe webbing and emarginate disk covers on some digits. The webs between toes III–IV extend at most only slightly distal to the proximal subarticular tubercles in these forms. In most other members of the *fitzingeri* group from Lower Central America (*Eleutherodactylus andi*, *E. crassidigitus*, *E. fitzingeri*, *E. longirostris*, and *E. raniformis*) the toe webs are moderate to extensive



Fig. 1. Holotype of *Eleutherodactylus phasma* (CRE 5331) in life.

and minimally encompass the proximal subarticular tubercles on all toes. The new form differs from *E. emcelae*, *E. monnichorum*, and *E. rayo* most obviously in lacking a definite large heel tubercle.

Eleutherodactylus phasma also differs from *E. talamancae*, a lowland species of the *fitzingeri* group having basal toe webs, in the predominantly gray-white dorsum, flanks, limb surfaces, and venter. In *E. talamancae*, the upper surfaces are tan to dark brown with some darker markings, the posterior thigh is uniform, pale yellowish-brown to reddish and suffused with red in life, as is the groin region. *Eleutherodactylus phasma* differs from *E. talamancae* in that it has a weak tarsal fold, the skin of the dorsum smooth, and it lacks a dark eye mask. *Eleutherodactylus talamancae* by

comparison, lacks a tarsal fold and has a finely tuberculate dorsum and black eye mask.

The only other form with which the new species might be confused is *E. cuaquero* of the Cordillera de Tilaran of northwestern Costa Rica (Savage 1980). *Eleutherodactylus phasma* differs from that species (characters for *E. cuaquero* in parentheses) in having smaller disks on fingers III–IV, their width being less than the length of the inner metatarsal tubercle (greater in *E. cuaquero*), and in having a uniform gray-white ventral and posterior thigh surface (venter bright yellow, suffused with pink posteriorly and posterior thigh with yellow-white lines and spots on dark brown ground color). *Eleutherodactylus melanostictus*, a member of the *fitzingeri* group that is sym-

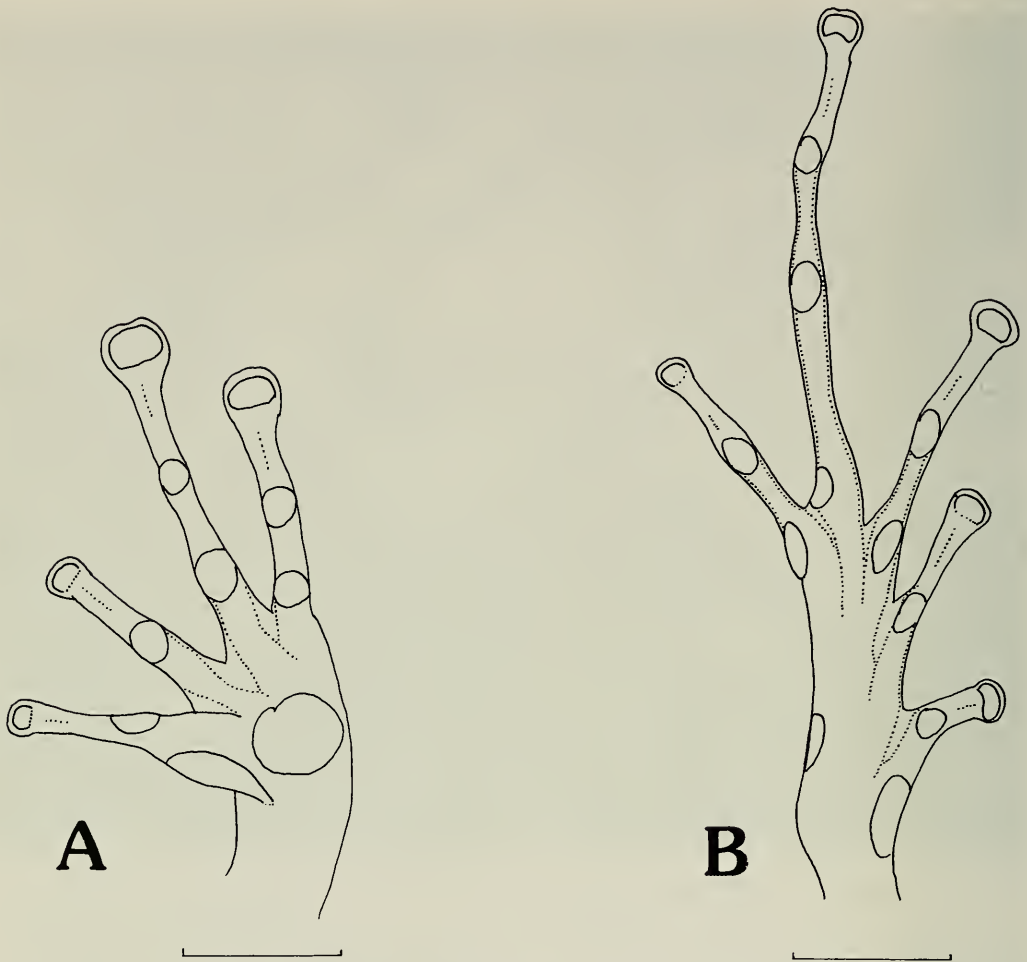


Fig. 2. Diagram of A) hand and B) foot of holotype, showing characteristics of webbing, tubercle, and disk shape. Bar indicates A) 3 mm and B) 5 mm.

patric with *E. phasma*, is easily distinguished from it by lacking any trace of toe webbing and having a distinct heel tubercle, granulate venter and the posterior thigh surface marked with vertical bars and scarlet interspaces.

General characteristics.—Head relatively narrow, slightly longer than broad; snout subovoid in dorsal outline; snout profile obtuse. Canthus rostralis sharp. Loreal region obtuse, upper lip not flared in cross section. Choanae ovoid, slightly smaller than vomerine tooth patches; posterior but internal to choanae, widely separated on midline. Surface of head smooth, without pustules;

upper eyelid smooth. Tympanum distinct, elliptical, vertical diameter slightly more than $\frac{1}{2}$ length of orbit; bordered above and posteriorly by a distinct glandular ridge. Dorsum, flanks and upper limb surfaces smooth. Finger I longer than II when adpressed together; relative finger lengths $III > IV > I > II$ (Fig. 2a). Disk on finger I rounded, slightly wider than finger. Disk on finger II slightly expanded and truncate. Disks on fingers III and IV expanded, that of III truncate, emarginate, almost twice as wide as finger, width equals that of tympanum; disk pads broadened and truncate. Subarticular tubercles under fingers round

in outline, globular in profile, and slightly projecting; no supernumerary tubercles; thenar tubercle large, elongate; palmar tubercle very large, cordate; no obvious accessory palmar tubercles. No distinct heel tubercle or calcar. Toe disks smaller than finger disks, disk on III larger than disks on other toes, equal to disk on finger II; disks on toes II–IV truncate, palmate and only slightly expanded on toes I and V. Relative toe lengths $IV > III > V > II > I$; toe III much longer than toe V (Fig. 2b). Slight basal toe webbing between toes I–IV; toe webbing formula $I2 -2\frac{3}{4}II2 -3\frac{1}{4}III3 -4\frac{1}{4}IV4\frac{1}{4} -2\frac{3}{4}V$. Subarticular tubercles under toes round, slightly projecting, globular in profile. No supernumerary nor plantar tubercles; inner metatarsal tubercle well-developed, elongate; outer metatarsal tubercle moderate and low; weak inner tarsal fold present. No inguinal gland; venter smooth.

Coloration.—Dorsal ground color dirty white to faint gray-brown. Scattered small brown punctuations contribute to gray-brown tint of dorsum. Scattering of 15–20 small black spots forming dark blotches posterior and medial to eyes. Upper lips pale gray-brown to black, color becoming more distinct along edges of canthus and nasal area. Black line extending from just anterior to eyes, along edge of upper eyelid and posterior to eye; upper $\frac{3}{4}$ of tympanum colored similarly, with eye line continued posterior to tympanum, but interrupted dorsally. Two black spots on posterior tibia and knee of left leg. Right knee slightly suffused with same dark gray-brown color. Tubercles of feet also colored gray-brown. Remainder of all dorsal, ventral and lateral areas dirty white to light gray-brown. Jaw muscle formula (after Savage 1987) $dfsqt + e$.

Measurements.—Measurements were taken following Lynch and Duellman (1980). Standard length (SL) 47.9 mm (all measurements in mm, those in parentheses given as percent of SVL); head length 19.5 (40.8); head width 18.5 (38.6); length of eye 6.2 (13.0); snout length 6.6 (12.7); lo-

real length 14.8 (30.8); vertical tympanum diameter 3.7 (7.6); hind limb length 89.9 (187.7); tibia 31.7 (66.3).

Distribution.—Known only from the type locality in the Lower Montane Rainforest (Holdridge 1982) in the Cordillera de Talamanca of Costa Rica near the Panama border at 1850 m elevation.

Remarks.—The type specimen was collected from the rocky banks of the Río Coton during a rainy afternoon in the early wet season. This site is within a transect that was monitored at intervals of 1–4 d over a period of 24 months from July 1991–June 1994. No other specimens were ever seen.

The addition of *E. phasma* brings the total number of *Eleutherodactylus* species at this site to seven: *E. crassidigitus*, *E. cruentus*, *E. hylaeformis*, *E. melanostictus*, *E. phasma*, *E. podiciferus*, *E. punctariolus*.

Discussion

On the basis of external morphology *Eleutherodactylus phasma* clearly belongs to the *fitzingeri* species group (Savage 1987), agreeing with most other members of this stock in habitus and in having a smooth venter, inner tarsal fold, and some toe webbing. This assignment is further confirmed by an examination of the jaw muscles. As noted by Lynch (1986) and Savage (1987), the *fitzingeri* group is part of the Middle American clade or “subgenus *Craugaster*”, characterized by having only an externus superficialis mandibular adductor muscle. *Eleutherodactylus phasma* has a mandibular depressor arrangement ($dfsqt$) typical of the *fitzingeri* group.

Relationships among the species within the *fitzingeri* group remain obscure. *Eleutherodactylus melanostictus* of montane Costa Rica and western Panama (no toe webs, granulate venter) and *E. talamancae* of the Atlantic lowlands from Nicaragua to eastern Panama, (no tarsal fold) are outliers in the range of interspecific variation in these characters. Lynch (1985) suggested that the emarginate disks of *E. emcelae* and

E. monnichorum, both of montane western Panama, and *E. melanostictus* formed a synapomorphy for this subset of species. Savage (1987) noted that most species in the *fitzingeri* group have some emarginate digital disks, and that marked differences exist in toe webbing (absent to moderate), heel tuberculation (present or absent) and posterior thigh coloration (uniform to large light spots or dark bars) among these species. While these features in various combinations aid in species recognition, we lack confidence that their occurrence in two or more species contains phylogenetic information (i.e. are non-homoplasious).

Although *E. phasma* is similar in morphological features to *E. cuaquero* (see diagnosis above), they differ markedly in coloration and to a lesser extent in habitus. *Eleutherodactylus cuaquero* appears to be a more robust species but has much longer legs (227–230% of standard length) than *E. phasma*. In these features and in the size of finger disks III–IV, the new form most closely resembles the sympatric *E. crassidigitus*, a wide-ranging (40–1800 m elevation) species found in Costa Rica and Panama. *Eleutherodactylus crassidigitus* differs markedly from *E. phasma* in having more toe webbing than any other member of the *fitzingeri* group (modal formula: I2⁻ -2III1½ -3 -III2 -3½IV4⁻ -2½V), predominantly brown upper surfaces and a uniform brown to reddish brown posterior thigh.

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